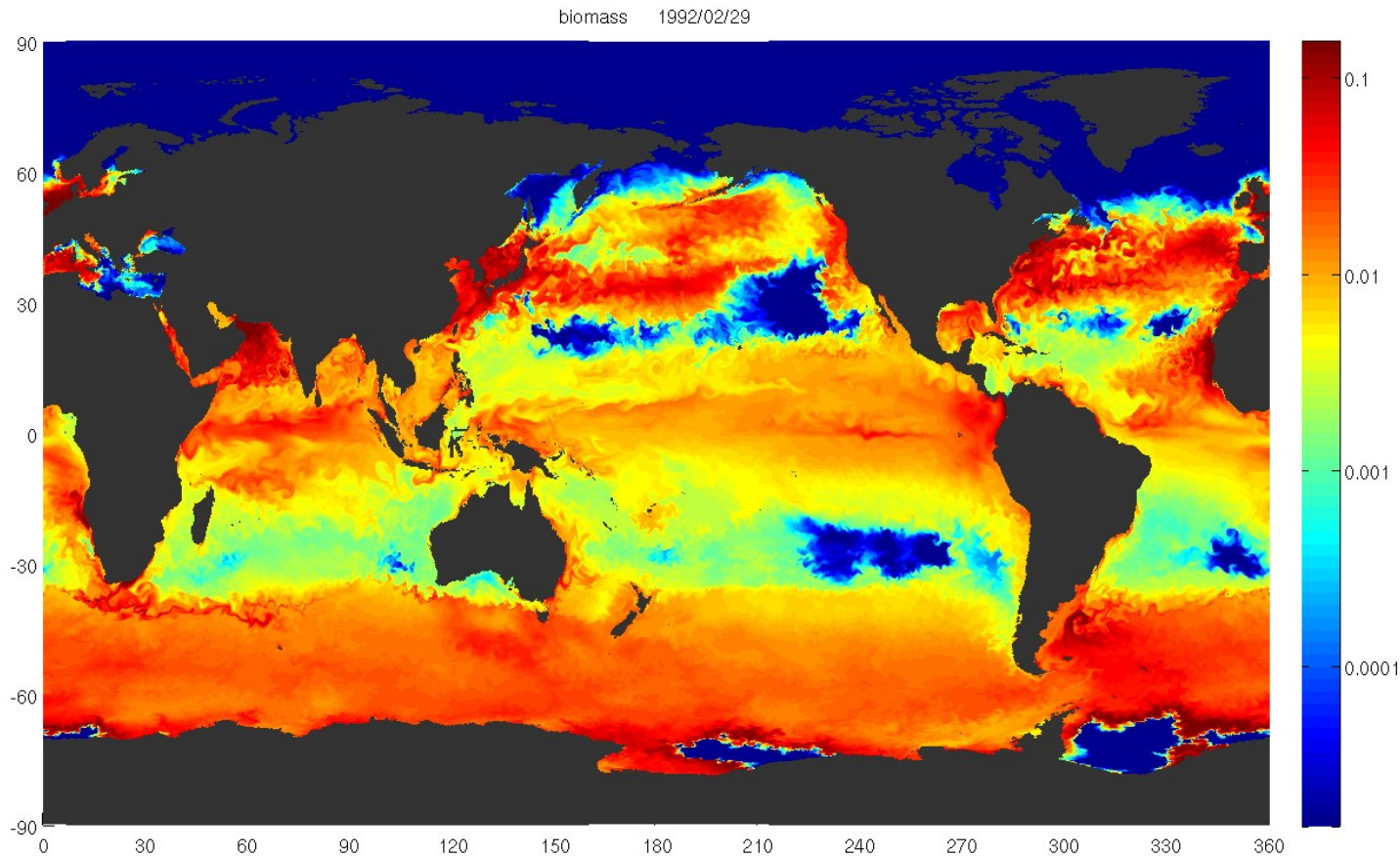


# Biogeochemistry with many tracers at high resolution

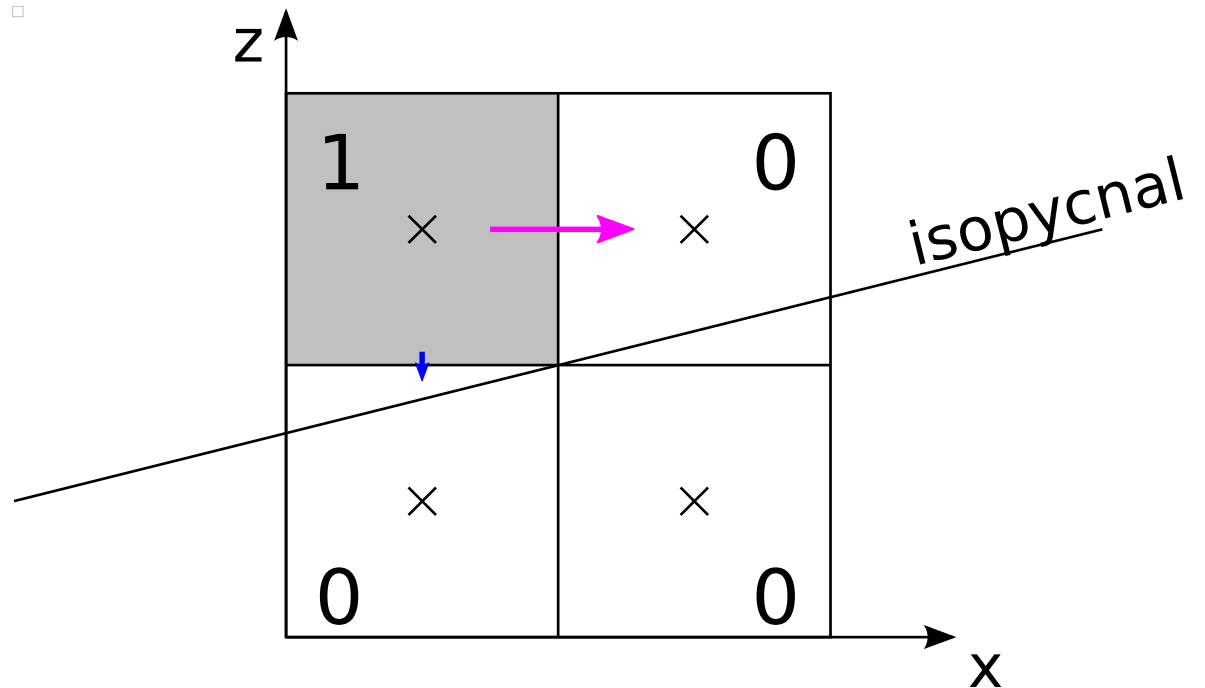


## Challenges:

- 99 tracers
- $1/6^\circ$  resolution, global
- Non-linear equations

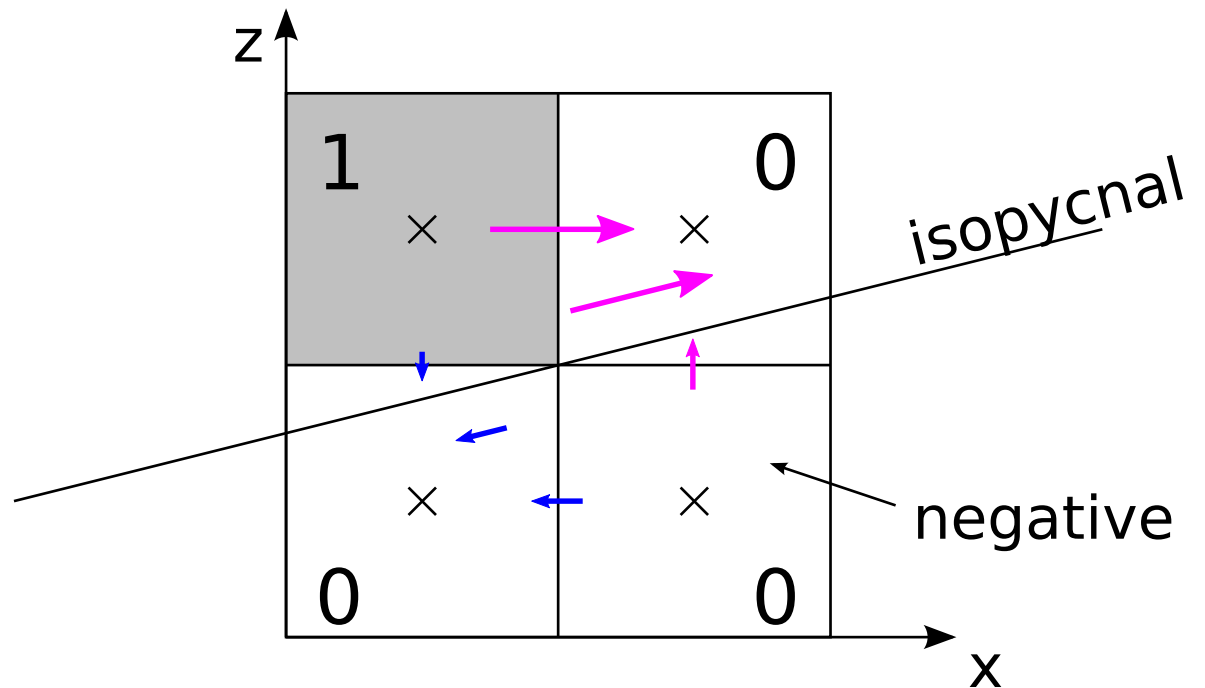
# Positive Definite Redi

- Biogeochem may require positive definite advection/diffusion (nonlinear equations sensitive to over/undershoots)
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- Steep gradients: □



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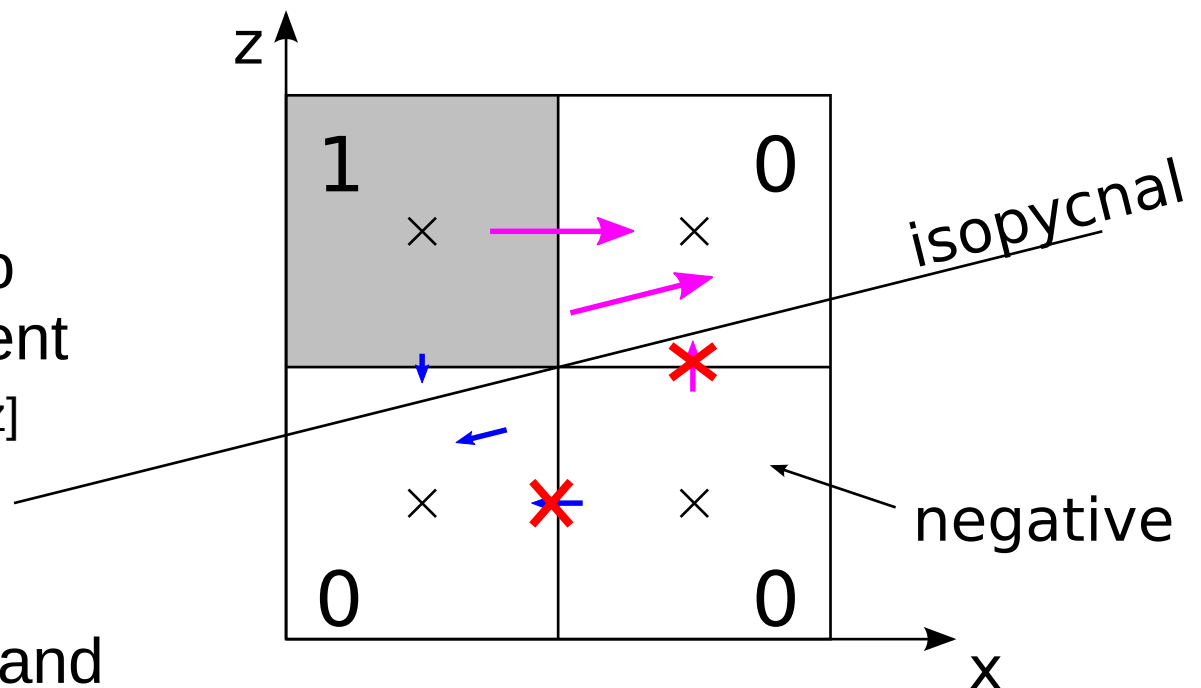


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- Interest in marginal species
- Steep gradients:

- Scale outgoing flux to less than tracer content of cell [Bott/Smolarkiewicz]

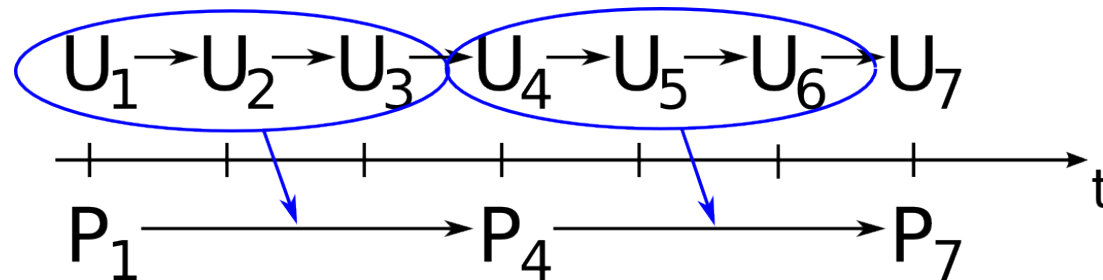
- Used for aquaplanet and phytoplankton mutations



# Many passive tracers

Added to MITgcm kernel:

- Full support for ~3000 tracers (incl. diagnostics) [Chris Hill]
- Long tracer time step (pkg/longstep)



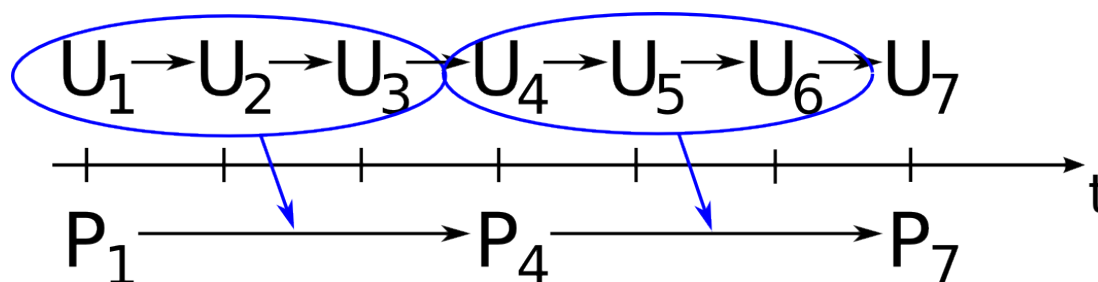
Makes possible:

- 78 species (99 ptracers)
  - cs510 grid ( $1/6^\circ$  resolution)
- at 3-4 months/day on 360 cores.

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DO_STATEVARS_DIAGS 16.85s	
LOAD_FIELDS_DRIVER 12.47s	
DO_OCEANIC_PHYS 51.31s	
DYNAMICS 33.64s	
SOLVE_FOR_PRESSURE 13.27s	
BLOCKING_EXCHANGES 51.54s	
THERMODYNAMICS 33.8s	
ptracer adv/diff	
LONGSTEP_THERMODYNAMICS 337.8s	
bio eq. GCHEM_FORCING_SEP 100.7s	